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An Aerial Noise Monitoring Study, Volume 2
Operations Handbook

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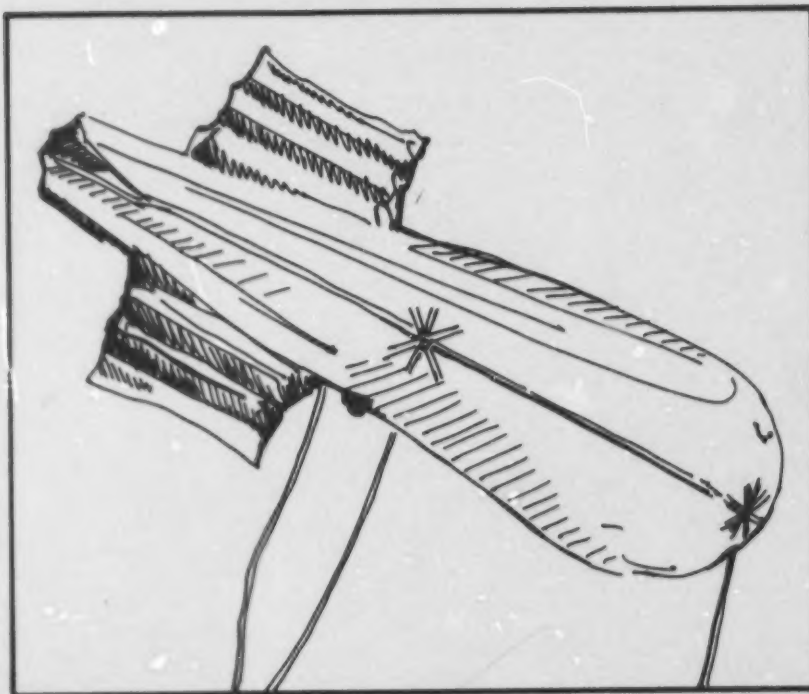
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AERIAL NOISE MONITORING STUDY
VOLUME II
OPERATIONS HANDBOOK

by

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SECTION 1

AERIAL NOISE MONITORING SITE SELECTION

SITE SELECTION

In order to implement an aerial noise monitoring program the noise monitoring sites in the potential monitoring area must be selected such that the aerial monitoring will yield an accurate noise profile of the community, that is, the sites must be representative of the diverse characteristics of the community. In addition to adequate representation, the sites must also meet certain physical requirements for the safe operation of the monitoring equipment.

SITE REQUIREMENTS

Once the potential monitoring sites have been chosen they should be inspected to make sure that they meet the following minimum requirements for safe operations:

1. There should be a clear area for ground operations approximately 30 x 30 m. in diameter so that the operations can be conducted without unnecessary hazard.
2. Buildings in the general vicinity of the operations site should be not more than 30 meters in height.
3. The operations area must be well clear of any aerial high tension power lines or aerial telephone lines which could interfere with the balloon.
4. The operations must be removed from any low altitude aircraft traffic patterns. Federal Aviation Agency (FAA) regulations provide that no person may operate a moored balloon within five (5) miles of the boundary of any airport.

FAA REGULATIONS

The FAA regulations which govern the operation of moored balloons are found in the Federal Air Regulations, Sections 101.1 through 101.19. Applicable regulations which were in effect 4-17-79 are reproduced in their entirety below. Regulations are subject to change at any time, and current regulations should be consulted.

101.1 Applicability

(a) This part prescribes rules governing the operation in the United States of the following:

(1) Except as provided for in S. 101.7, any balloon that is moored to the surface of the earth or an object thereon and that has a diameter of more than 6 feet or a gas capacity of more than 115 cubic feet.

(2) Except as provided for in S. 101.7, any kite that weighs more than 5 pounds and is intended to be flown at the end of a rope or cable.

(3) Any unmanned rocket except;

(i) Aerial fireworks displays; and

(ii) Model rockets:

(a) using not more than four ounces of propellant;

(b) using a slow-burning propellant;

(c) made of paper, wood, or breakable plastic, containing no substantial metal parts and weighing not more than 16 ounces, including the propellant; and

(d) operated in a manner that does not create a hazard to persons, property or other aircraft.

(4) Except as provided for in S.101.7, any unmanned free balloon that:

(i) Carries a payload package that weighs more than four pounds and has a weight/size ratio of more than three ounces per square inch on any surface of the package, determined by dividing the total weight in ounces of the payload package by the area in square inches of its smallest surface;

(ii) Carries a payload package that weighs more than six pounds;

(iii) Carries a payload of two or more packages, that weighs more than 12 pounds; or

(iv) Uses a rope or other device for suspension of the payload that requires an impact force of more than 50 pounds to separate the suspended payload from the balloon.

(b) For the purposes of this part, a "gyroglider" attached to a vehicle on the surface of the earth is considered to be a kite.

101.3 Waivers

No person may conduct operations that require a deviation from this part except under a certificate of waiver issued by the Administrator.

101.5 Operations in prohibited or restricted areas

No person may operate a moored balloon, kite, unmanned rocket, or unmanned free balloon in a prohibited or restricted area unless he has permission from the using or controlling agency, as appropriate.

101.7 Hazardous Operations

(a) No person may operate any moored balloon, kite, unmanned rocket, or unmanned free balloon in a manner that creates a hazard to other persons, or their property.

(b) No person operating any moored balloon, kite, unmanned rocket, or unmanned free balloon may allow an object to be dropped from it, if such action creates a hazard to other persons or their property.

101.11 Applicability

This subpart applies to the operation of moored balloons and kites. However, a person operating a moored balloon or kite within a restricted area must comply only with S.101.19 and with additional limitations imposed by the using or controlling agency as appropriate.

101.13 Operating Limitations

(a) Except as provided in paragraph (b) of this section, no person may operate a moored balloon or kite --

- (1) Less than 500 feet from the base of any cloud;
- (2) More than 500 feet above the surface of the earth;
- (3) From an area where the ground visibility is less than three miles; or

(4) Within 5 miles of the boundary of any airport.

(b) Paragraph (a) of this section does not apply to the operation of a balloon or kite below the top of any structure and within 250 feet of it, if that shielded operation does not obscure any lighting on the structure.

101.15 Notice Requirements

No person may operate an unshielded moored balloon or kite more than 150 feet above the surface of the earth unless, at least 24 hours before beginning the operation, he gives the following information to the FAA ATC facility that is nearest to the place of intended operation:

- (a) The names and addresses of the owners and operators.
- (b) The size of the balloon or the size and weight of the kite.
- (c) The location of the operation.
- (d) The height above the surface of the earth at which the balloon or kite is to be operated.
- (e) The date, time, and duration of the operation.

101.17 Lighting and Marking Requirements

(a) No person may operate a moored balloon or kite, between sunset and sunrise unless the balloon or kite, and its mooring lines, are lighted so as to give a visual warning equal to that required for obstructions to air navigation in the FAA publication "Obstruction Marking and Lighting".

(b) No person may operate a moored balloon or kite between sunrise and sunset unless its mooring lines have colored pennants or streamers attached at not more than 50 foot intervals beginning at 150 feet above the surface of the earth and visible for at least one mile.

101.19 Rapid Deflation Device

No person may operate a moored balloon unless it has a device that will automatically and rapidly deflate the balloon if it escapes from its moorings. If the device does not function properly, the operator shall immediately notify the nearest ATC facility of the location and time of the escape and the estimated flight path of the balloon.

FCC APPROVAL

Applicable regulations regarding use of the radio spectrum for telemetering purposes must be complied with. The user should determine that appropriate arrangements have been made with the Federal Communications Commission.

FAA AUTHORITIES

Before commencing aerial noise monitoring operations on any particular day, it is required that the operators contact the FAA ATC (Flight Service Station, FSS) facility that is closest to the operations and advise them of their planned activities. In addition, the nearest airport Air Traffic Control (ATC) tower should be apprised of the operations, and any local airports should be contacted. Notifying these three authorities is mandatory because there is no regular interchange of information between them.

LOCAL AUTHORITIES

Local authorities whose activities may be affected by the aerial noise monitoring operations should also be contacted before commencing operations, as a courtesy, if nothing else. During the Boulder operations affected agencies included the City of Boulder police department and the City of Boulder parks and recreation department, since one of the monitoring sites was a city park.

POWER SUPPLY

The operations site must be within 61 meters of a source of 120 V AC electrical power. Usually the most convenient and practical source is a nearby house, if permission from the homeowner can be obtained.

Under no circumstances should extension cords from the power source be stretched across a street with traffic on it, or exposed to any other conditions that might jeopardize the integrity of the power cord, since even a momentary loss of power will result in the loss of the statistical measurements during that period of monitoring.

INSURANCE COVERAGE

For the protection of all parties involved in the aerial monitoring project adequate insurance coverage should be obtained prior to commencing aerial monitoring operations. This insurance coverage should protect the project operators from liability for any persons or property on the ground, and from liability for any airborne property and persons, that is, airplanes. In addition, any employees involved in conducting the aerial noise monitoring

operations should be covered by workman's compensation insurance. Individual coverage requirements should be based on the prevailing local conditions and regulations.

BALLOON PROCUREMENT

Because of the altitude restrictions imposed on aerial monitoring projects by the FAA, any balloon capable of carrying the 2 kg. payload and which coincides with all other applicable FAA rules may be used as the aerial monitoring balloon. EDI used a thin plastic balloon which was 4.9 m. in length, 1.4 m. in diameter, weighed 1.7 kg., and had a nominal volume of 3.25 m³.

SECTION 2

OPERATIONS PROCEDURES

PREFLIGHT PREPARATIONS

Following the selection of monitoring sites which are adequate insofar as the safety of the aerial noise monitoring operations are concerned, and representative of the diverse acoustic environments of the sampling area to be monitored, a complete inspection of the equipment necessary to perform the aerial noise monitoring should be conducted.

The balloon operators should make sure they have all the equipment they need for the monitoring operations before they drive to the monitoring site, since having to make extra trips for forgotten equipment will seriously disrupt the continuous acquisition of data during the monitoring day.

PREFLIGHT EQUIPMENT CHECKLIST

An extensive list of tools and equipment is necessary to perform the aerial noise monitoring operations. It is important to have duplicates of many items on hand in case the first set of the item, such as batteries, fails.

The following is a checklist of the equipment necessary to conduct aerial noise monitoring operations. The operators should go through the checklist carefully in preparation for the monitoring activities.

Equipment Checklist

1 Microdyne Receiver	)	
1 EDI Receiver/Filter	)	
1 Audio Amplifier	)	Ground Station
1 Speaker (3 ohm)	)	

- 1 Statistical noise analyzer
- 1 Graphic level recorder
- 1 Tape recorder
- 1 Antenna cable
- 1 BNC to XLR cable
- 1 DIN to BNC cable
- 1 ¼" phone plug (two conductor) to phono plug (1 meter)
- 2 BNC TEE connectors
- 1 A.C. power buss (4 outlets)
- 2 328 meter #10 AWG A.C. power extension cords
- 1 roll of patching tape (Borden Mystik tape or equivalent)
- 2 Bottles helium
- 1 winch
- 1 wind screen
- 1 balloon
- 1 drop tarp
- 1 spool 130 kg. test monofilament line (spare)
- 1 Acoustical calibrator
- 1 Telemetry package
- Batteries required for battery powered equipment
- TR431 Mallory Mercury Duracell batteries (or equivalent) as required for telemetry package
- data sheets as required
- miscellaneous tools as required for above equipment
- binoculars (optional)
- headphone, 8 ohm (optional)

MONITORING EQUIPMENT SETTINGS

The equipment used for the aerial noise monitoring is highly sensitive and must be handled with care to avoid damaging it or interfering with accurate readings during actual noise monitoring. Prior to arrival at the noise monitoring site the system components should be connected together as in Figure 1 and all connections double-checked. Then the equipment to be used during noise monitoring operations should be set to the correct operational settings; these should be rechecked at the site. Correct settings for each equipment item follow:

Statistical analyzer

See manufacturer's manual for information concerning duration of runs.

Weighting - A

Fast or Slow Response, depending on the applicable requirements

Microdyne Receiver

Operation mode - Rec
Audio gain - full counter clockwise
Video bandwidth - 100 KHz
Gain - see calibration and measurement procedure
Video coupling - AC
Video source - FM/PM
Deviation Range - 50 KHz
IF bandwidth - 0.5 MHz
Fine tune - Mid position (12:00)
Search range-- Mid position (12:00)
2nd Lo Mode - VFO
1rst Lo Mode - VFO
AGC time constant - 1.0 MSEC
Main gain - Mid position (12:00)
Tuning - see calibration and measurement procedure

EDI Rec/Filter

Front Panel Settings

Operation Mode - ON

Tape Recorder

Volume - set as required
Record level - see calibration and measurement procedure
Speed - at least 9.5 cm/sec.

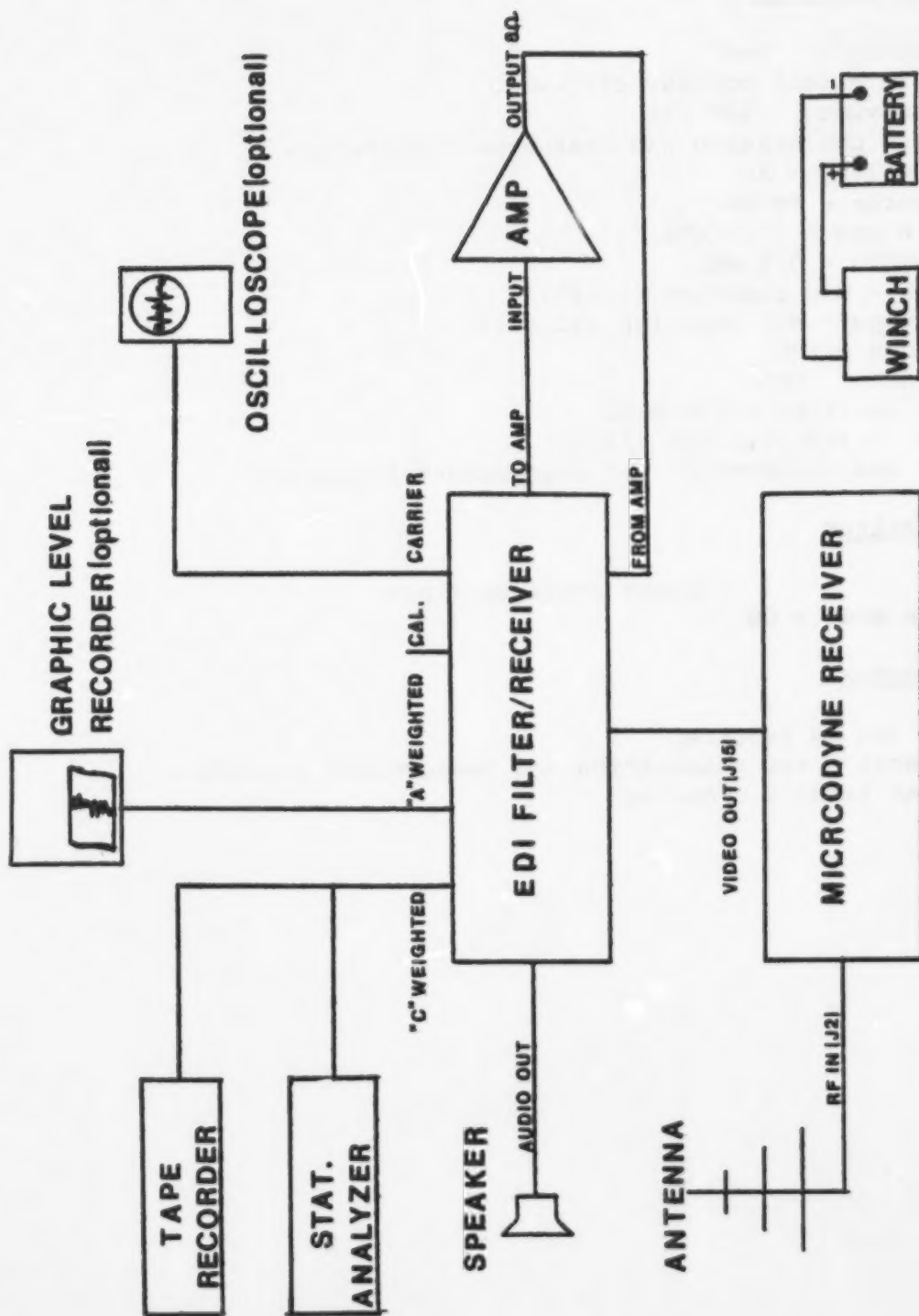


Figure 1

ACOUSTICAL CALIBRATION

To ensure complete system accuracy during aerial noise monitoring operations each piece of equipment must be checked for accuracy. During the winter these operations should be performed indoors, since the power output of the batteries used in the system declines with cold, and calibration may be off as a result. However, calibration must be repeated at the site to correct for temperature effects and for any changes due to transportation. It is important to record the exact calibration levels on the tape recordings and on the field data sheets for later reference. The following checklist gives the exact procedure to follow for preflight calibration.

Calibration and Measurement Procedure

1. Connect the equipment as in Figure 1 and set controls as per monitoring equipment settings. Use a single point ground to avoid ground loop.
2. Connect the batteries in the telemetry package.
3. Place the telemetry package in a position so that there is an unobstructed path from it to the receiving antenna.
4. Apply 120 V AC (200 watts) power to the ground station.
5. Tune in the carrier by turning the tuning knob on the Microdyne Receiver until the carrier indicator (CARR. IND.) light comes on and the tuning meter is centered.
6. Once the carrier is tuned in, switch the 2nd LO MOD to AFC.
7. Adjust video gain until video output meter reads 0 dB.
8. Turn on the statistical analyzer.
9. Prepare the tape recorder for taping.
10. Set the dB range switch on the telemetry package to the appropriate range for the calibrator used.
11. Turn on calibrator and place it over the microphone.
12. Adjust calibration control on the statistical analyzer for proper reading.
13. Start the tape recorder and adjust the recording level according to manufacturer's recommendations.
14. Shut off tape recorder after approximately 30 seconds.
15. If used, adjust graphic level recorder for proper level.
16. Remove and shut off the calibrator.
17. Shut off the statistical analyzer.

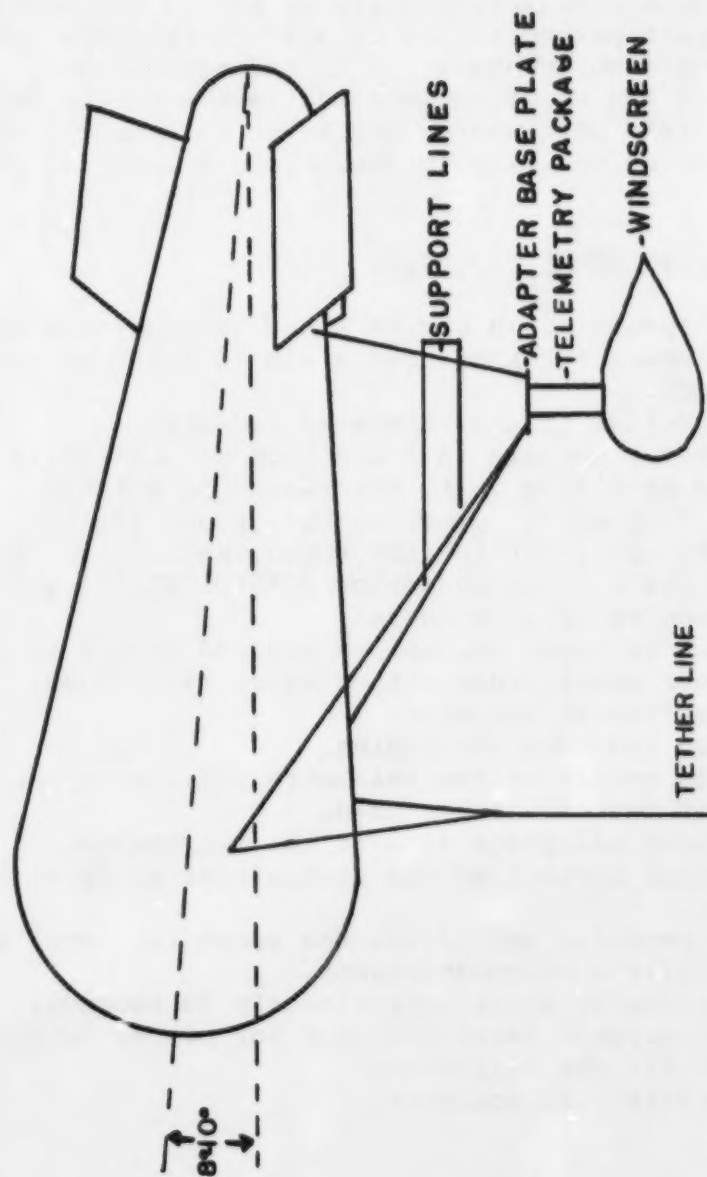


Figure 2

BALLOON PREPARATION

The following instructions cover the preflight preparation and operation of the balloon:

1. Lay out a ground cloth for the balloon.
2. Tether the balloon to the winch line.
3. Place the filler hose on the helium bottle.
4. Place the other end of the filler hose into the filler tube of the balloon.
5. Slowly fill the balloon with helium; prevent the balloon from touching any sharp objects.
6. Fill the balloon to the manufacturer's recommendations.
7. Seal the balloon filler tube.
8. Adjust the support lines as in Figure 2.
9. Affix the telemetry package to the adapter base plate on the support lines as in Figure 2.
10. Raise the balloon by turning the winch on.
11. If inflation is satisfactory, lower the balloon.

Once the above check-out has been satisfactorily performed the system is ready to be transported to the site to conduct the aerial monitoring. It is recommended that a vehicle such as a step van be used for transportation of the aerial monitoring system from site to site. The cargo space of the van should be large enough to transport the balloon just slightly deflated so that helium can be conserved from day to day.

Upon arrival at the monitoring site, unpack the equipment and proceed as follows:

1. Repeat the calibration and measurement procedure.
2. Repeat the balloon preparation procedure.
3. Ascend the balloon to the monitoring altitude.
4. Orient the receiving antenna towards the telemetry package.
5. Repeat tuning if necessary.
6. Enable the statistical analyzer, tape recorder, and graphic level recorder.

It may be necessary to bring the balloon down during the course of the day to refill it with helium. It is recommended that the calibration procedure be repeated while the balloon is down.

EMERGENCY PROCEDURES

Whenever the aerial noise monitoring is in progress the weather conditions should be closely monitored for adverse developments such as thunder storms, gusting winds, etc. If adverse conditions seem imminent the balloon should be lowered and if necessary put into the back of the van until the weather clears.

Blow-down Conditions

Occasionally during aerial noise monitoring operations the weather will change very suddenly with the approach of a storm and the wind velocity will pick up dramatically. Under these conditions the tension on the tether line increases so much that the winch may wind in the line too slowly to save the balloon in time. If this happens the tether line should be pulled in manually, ie. hand over hand, as quickly as possible and the other operator should make certain that the tether line is then neatly reeled onto the winch.

Balloon Escape

If the tether line breaks and the balloon escapes the following procedure should be followed immediately:

1. One person should remain at the site and try to visually track the balloon or at least estimate its escape path.
2. The closest Flight Service Center should be notified immediately of the escape. Supply them with the time of escape and the approximate direction of flight.
3. Notify the local airport control tower.
4. If the balloon cannot be tracked visually and recovered immediately, notify the sheriff's offices in the surrounding counties by telephone and give them the pertinent information regarding the balloon's escape. When the EDI balloon escaped it was recovered the next day from a farmer's field after the landing was reported to the county sheriff.
5. The telemetry package should have the identification of the persons doing the aerial noise monitoring attached to it.

MAINTENANCE PROCEDURES

The equipment used for aerial noise monitoring should be periodically inspected for wear and maintained as necessary. All moving mechanical parts should be lubricated with a good quality grease and the electronic equipment should be serviced by a qualified repairman as indicated in the manufacturer's instruction manuals. Unexpected breakdowns of the equipment will only frustrate the aerial noise monitoring efforts, or result in the acquisition of unaccurate or unreliable data.

The operating instructions contained in this aerial noise monitoring handbook should be supplemented by the operation manuals for each individual equipment component, which provide detailed operating instructions and technical information

The operators of the aerial noise monitoring system should have a proficient familiarity with acoustical measurement techniques as well as good mechanical aptitude and a basic understanding of electronics. EDI has demonstrated that well-skilled individuals may be taught to operate the aerial noise monitoring system reliably in a short period of time.